U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-284 669

Lower Otay Reservoir
San Diego County, California

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Feb 78

PB 284 669

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

G.P.O. 699-440

TECHNICAL REPORT DATA *(Please read Instructions on the reverse before completing)*		
1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO. PB284669
4. TITLE AND SUBTITLE Report on Lower Otay Reservoir, San Diego County California		5. REPORT DATE Prepared February 1979 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper # 754
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pacific Northwest Environmental Research Laboratory U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final -1975 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114		

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading	National Eutrophication Survey Lake Survey	05B 05C

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release Unlimited	Unclassified	33
	20. SECURITY CLASS *(This page)*	22. PRICE
		A03-A01

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

REPORT

ON

LOWER OTAY RESERVOIR

SAN DIEGO COUNTY

CALIFORNIA

EPA REGION IX

WORKING PAPER No. 754

WITH THE COOPERATION OF THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

AND THE

CALIFORNIA NATIONAL GUARD

FEBRUARY, 1978

CONTENTS

	Page
Foreword	ii
List of California Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Introduction	1
II. Conclusions	1
III. Reservoir and Drainage Basin Characteristics	3
IV. Water Quality Summary	4
V. Literature Reviewed	8
VI. Appendices	9

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentration (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the California State Water Resources Control Board and the nine Regional Water Quality Control Boards for professional involvement, to the California National Guard for conducting the tributary sampling phase of the Survey, and to those California wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the Division of Planning and Research of the State Water Resources Control Board provided invaluable lake documentation and counsel during the Survey, coordinated the reviews of the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

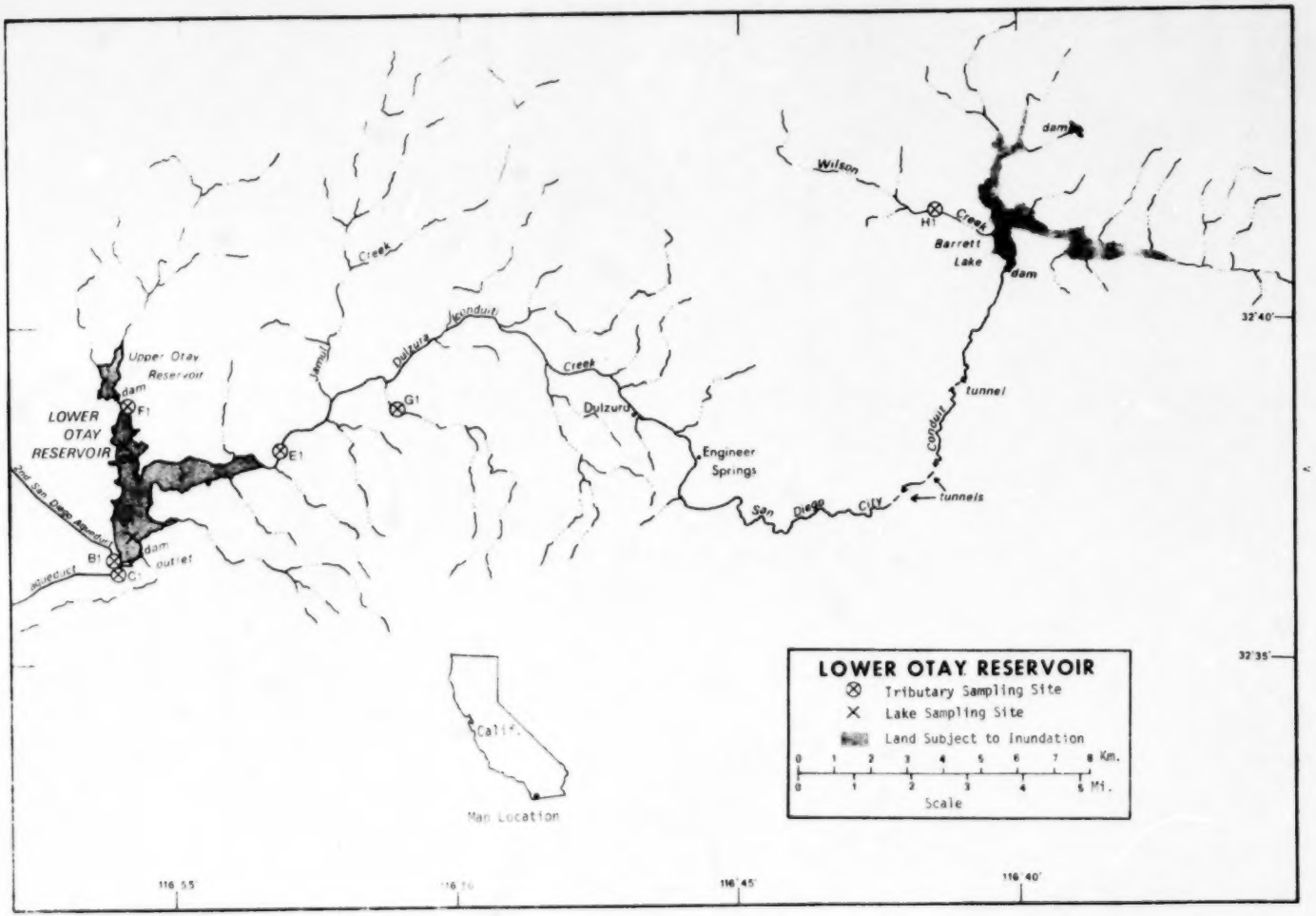
Major General Glen C. Ames, the Adjutant General of California, and Project Officer Second Lieutenant Terry L. Barrie, who directed the volunteer efforts of the California National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of California

Name	County
Amador	Amador
Boca	Nevada
Britton	Shasta
Casitas	Ventura
Crowley	Mono
Don Pedro	Tuolumne
Elsinore	Riverside
Fallen Leaf	El Dorado
Hennessey	Napa
Henshaw	San Diego
Iron Gate	Siskiyou
Lopez	San Luis Obispo
Mary	Mono
Mendocino	Mendocino
Nicasio	Marin
Lower Otay	San Diego
Pillsbury	Lake
Santa Margarita	San Luis Obispo
Shasta	Shasta
Shaver	Fresno
Silver	Mono
Tahoe	El Dorado, Placer, CA; Carson City, Douglas, Washoe, NV
Tulloch	Calaveras, Tuolumne
Lower Twin	Mono
Upper Twin	Mono


Wilson
Creek
H1
dam
Barrett
Lake
dam
32°40'
tunnel
conduit
tunnels
San Diego City
Engineer
Springs
Dulzura
Creek
Dulzura
conduit
Jamul
Creek
G1
E1
Upper Otay
Reservoir
dam
F1
LOWER
OTAY
RESERVOIR
San Diego Aqueduct
B1
C1
dam
outlet
aqueduct
Calif.
Map Location
LOWER OTAY RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Land Subject to Inundation
0 1 2 3 4 5 6 7 8 Km.
0 1 2 3 4 5 Mi.
Scale
32°35'
116°55'
116°50'
116°45'
116°40'

LOWER OTAY RESERVOIR

STORET NO. 0618

I. INTRODUCTION

Because of lack of flows, only one sample was taken from each of the two gaged inlet tributaries during the sampling year (stations E-1 and F-1; see map, page v). Therefore, this report relates only to the reservoir sampling data.

The outlet data, the limited inlet sampling data, and the flow data are included in the appendices for the record.

II. CONCLUSIONS

A. Trophic Condition*:

Survey data indicate that Lower Otay Reservoir is eutrophic. It ranked twenty-second in overall trophic quality when the 24 California lakes and reservoirs sampled in 1975 were compared using a combination of six parameters**. Eighteen of the lakes had less median total phosphorus, 12 had less and one had the same median dissolved orthophosphorus, 20 had less median inorganic nitrogen and mean chlorophyll a, and 18 had greater mean Secchi disc transparency. Significant depression of dissolved oxygen with depth occurred at sampling station 1 in March and June. Destratification equipment (aeration) has been installed in this reservoir (Bailey, 1977).

Survey limnologists noted surface algal scums and extensive beds of submerged macrophytes in the reservoir in June. Copper

---

* Trophic assessment is based on the levels of nutrients, dissolved oxygen, and chlorophyll a; the phytoplankton kinds and numbers, and transparency (Allum et al., 1977).

** See Appendix A.

sulfate has been applied to the reservoir occasionally for the control of algae (Bailey, op. cit.).

B. Rate-Limiting Nutrient:

The algal assay results are not considered representative of conditions in the reservoir at the times of sampling (03/07/75 and 11/14/75). The reservoir data indicate phosphorus limitation at both stations in March, nitrogen limitation at both stations in June, and phosphorus limitation at station 1 but nitrogen limitation at station 2 in November.

III. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 4.58 kilometers^2.
2. Mean depth: 15.2 meters.
3. Maximum depth: 44.2 meters.
4. Volume: 69.557 x 10^6 m^3.

B. Precipitation*:

1. Year of sampling: 33.6 centimeters.
2. Mean annual: 35.7 centimeters.

---

† Table of metric equivalents--Appendix B.
†† Dendy, 1974.
* See Working Paper No. 175, "...Survey Methods, 1973-1976".

IV. WATER QUALITY SUMMARY

Lower Otay Reservoir was sampled three times in 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 11.6 meters at station 1 and 6.4 meters at station 2.

The sampling results are presented in full in Appendix C and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LOWER OTAY RESERVOIR
STORET CODE 0618

PARAMETER	1ST SAMPLING (3/ 7/75) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (6/20/75) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (11/14/75) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	11.9 - 14.0	13.2	13.4	11.3 - 19.8	17.3	19.2	16.5 - 17.1	16.8	16.7
DISS OXY (MG/L)	2.2 - 8.0	6.1	7.1	0.0 - 12.0	6.0	6.8	4.8 - 8.2	6.1	6.0
CNDCTVY (MCROMO)	911. - 966.	936.	934.	769. - 882.	849.	874.	767. - 782.	774.	775.
PH (STAND UNITS)	7.9 - 8.5	8.3	8.4	7.8 - 8.1	8.0	8.1	7.8 - 8.3	8.0	8.0
TOT ALK (MG/L)	159. - 171.	164.	164.	148. - 176.	154.	151.	140. - 148.	143.	142.
TOT P (MG/L)	0.050 - 0.087	0.063	0.058	0.033 - 0.198	0.056	0.038	0.064 - 0.092	0.079	0.081
ORTHO P (MG/L)	0.011 - 0.026	0.015	0.013	0.006 - 0.156	0.028	0.012	0.008 - 0.036	0.016	0.013
NO2+NO3 (MG/L)	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020	0.020 - 0.030	0.021	0.020
AMMONIA (MG/L)	0.200 - 0.260	0.222	0.215	0.050 - 0.440	0.107	0.070	0.110 - 0.260	0.170	0.160
KJEL N (MG/L)	0.800 - 1.700	1.100	1.050	0.800 - 1.100	0.878	0.800	0.600 - 0.900	0.800	0.800
INORG N (MG/L)	0.220 - 0.280	0.242	0.235	0.070 - 0.460	0.127	0.090	0.140 - 0.280	0.191	0.180
TOTAL N (MG/L)	0.820 - 1.720	1.120	1.070	0.820 - 1.120	0.898	0.820	0.620 - 0.920	0.821	0.820
CHLRPYL A (UG/L)	14.0 - 15.7	14.8	14.8	4.7 - 4.8	4.7	4.7	17.9 - 38.5	28.2	28.2
SECCHI (METERS)	****** -**********			1.5 - 1.7	1.6	1.6	0.9 - 1.2	1.1	1.1

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/07/75	1. Asterionella sp.	2,170
	2. Coelastrum sp.	457
	3. Cryptomonas sp.	381
	4. Scenedesmus sp.	304
	5. Oocystis sp.	266
	Other genera	381
	Total	3,959
06/20/75	1. Aphanizomenon sp.	370
	2. Dactylococcopsis sp.	148
	3. Dinobryon sp.	74
	4. Oscillatoria sp.	74
	5. Anabaena sp.	74
	Other genera	75
	Total	815
11/14/75	1. Oscillatoria sp.	6,873
	2. Chlamydomonas sp.	1,430
	3. Dactylococcopsis sp.	440
	4. Scenedesmus sp.	440
	5. Cryptomonas sp.	385
	Other genera	329
	Total	9,897

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
03/07/75	1	14.0
	2	15.7
06/20/75	1	4.8
	2	4.7
11/14/75	1	17.9
	2	38.5

C. Limiting Nutrient Study:

Significant nutrient changes occurred in the algal assay samples between the times of collection and the beginning of the assays, and the results are not considered representative of conditions in the reservoir at the times the samples were taken (03/07/75 and 11/14/75).

The reservoir data indicate phosphorus limitation at both stations in March (the mean inorganic nitrogen/orthophosphorus ratios were 15/1 and 18/1 at stations 1 and 2, respectively), nitrogen limitation at both stations in June (N/P ratios were 4/1 and 10/1), and phosphorus limitation at station 1 (N/P = 20/1) but nitrogen limitation at station 2 (N/P = 7/1) in November.

V. LITERATURE REVIEWED

Allum, M. O., R. E. Glessner, and J. H. Gakstatter, 1977. An evaluation of the National Eutrophication Survey data. Working Paper No. 900, Corvallis Env. Res. Lab., Corvallis, OR.

Bailey, Thomas E., 1977. Personal communication (reviews of preliminary reports). CA Water Res. Contr. Bd., Sacramento.

Dendy, William B., 1974. Personal communication (reservoir information and morphometry). CA Water Res. Contr. Bd., Sacramento.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0601	AMADOR RESERVOIR	0.040	0.390	408.667	22.383	14.600	0.020
0602	BOCA LAKE	0.012	0.040	372.833	1.700	6.800	0.003
0603	LAKE BRITTON	0.067	0.115	448.500	4.811	11.200	0.047
0604	CASITAS RESERVOIR	0.029	0.050	400.250	3.192	14.000	0.014
0605	CROWLEY LAKE	0.046	0.045	374.750	5.800	12.200	0.034
0606	DON PEDRO RESERVOIR	0.013	0.060	381.733	3.564	11.400	0.004
0607	LAKE ELSINORE	0.469	0.120	489.214	70.572	8.000	0.092
0608	FALLEN LEAF RESERVOIR	0.007	0.040	24.357	0.786	8.800	0.005
0609	LAKE HENNESSEY	0.027	0.060	416.000	4.525	15.000	0.012
0610	LAKE HENSHAW	0.138	0.070	461.000	26.783	9.800	0.073
0611	IRON GATE RESERVOIR	0.184	0.690	440.333	6.217	13.800	0.124
0614	LOPEZ LAKE	0.371	0.090	372.000	8.658	15.000	0.343
0615	LAKE MARY	0.010	0.040	296.000	2.550	10.600	0.002
0616	LAKE MENDOCINO	0.020	0.050	436.500	3.100	9.400	0.008
0617	NICASIO RESERVOIR	0.055	0.345	482.778	6.633	9.800	0.013
0618	LOWER OTAY RESERVOIR	0.058	0.180	447.250	15.933	15.000	0.013
0619	LAKE PILLSBURY	0.022	0.060	466.667	6.389	8.200	0.008
0620	SANTA MARGARITA LAKE	0.037	0.070	400.000	9.122	14.800	0.014
0621	SHASTA LAKE	0.021	0.060	381.542	4.087	9.000	0.015
0622	SHAVER	0.014	0.060	346.400	1.700	7.400	0.004
0623	SILVER LAKE	0.012	0.055	356.000	1.800	7.000	0.003
0624	TULLOCK RESERVOIR	0.025	0.060	433.000	13.878	7.400	0.009
0625	UPPER TWIN LAKES	0.015	0.040	300.200	3.340	7.400	0.004
0626	LOWER TWIN LAKES	0.014	0.040	248.000	2.900	11.400	0.003

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
0601	AMADOR RESERVOIR	35 (8)	4 (1)	43 (10)	9 (2)	17 (4)	26 (6)	134
0602	BOCA LAKE	89 (20)	98 (22)	70 (16)	91 (21)	100 (23)	91 (20)	539
0603	LAKE BRITTON	17 (4)	22 (5)	17 (4)	48 (11)	43 (10)	17 (4)	164
0604	CASITAS RESERVOIR	43 (10)	74 (17)	48 (11)	70 (16)	22 (5)	37 (8)	294
0605	CROWLEY LAKE	30 (7)	78 (18)	65 (15)	43 (10)	30 (7)	22 (5)	268
0606	DON PEDRO RESERVOIR	83 (19)	54 (11)	57 (13)	61 (14)	37 (8)	78 (17)	370
0607	LAKE ELSINORE	0 (0)	17 (4)	0 (0)	0 (0)	78 (18)	9 (2)	104
0608	FALLEN LEAF RESERVOIR	100 (23)	87 (19)	100 (23)	100 (23)	70 (16)	70 (16)	527
0609	LAKE HENNESSEY	48 (11)	54 (11)	39 (9)	52 (12)	4 (0)	52 (12)	249
0610	LAKE HENSHAW	13 (3)	33 (7)	13 (3)	4 (1)	54 (12)	13 (3)	130
0611	IRON GATE RESERVOIR	9 (2)	0 (0)	26 (6)	39 (9)	26 (6)	4 (1)	104
0614	LOPEZ LAKE	4 (1)	26 (6)	74 (17)	26 (6)	4 (0)	0 (0)	134
0615	LAKE MARY	96 (22)	87 (19)	91 (21)	83 (19)	48 (11)	100 (23)	505
0616	LAKE MENDOCINO	65 (15)	70 (16)	30 (7)	74 (17)	61 (14)	63 (14)	363
0617	NICASIO RESERVOIR	26 (6)	9 (2)	4 (1)	30 (7)	54 (12)	46 (10)	169
0618	LOWER OTAY RESERVOIR	22 (5)	13 (3)	22 (5)	13 (3)	4 (0)	46 (10)	120
0619	LAKE PILLSBURY	57 (13)	41 (9)	9 (2)	35 (8)	74 (17)	63 (14)	279
0620	SANTA MARGARITA LAKE	39 (9)	33 (7)	52 (12)	22 (5)	13 (3)	37 (8)	196
0621	SHASTA LAKE	61 (14)	54 (11)	61 (14)	57 (13)	65 (15)	30 (7)	328
0622	SHAVER	78 (18)	41 (9)	83 (19)	96 (22)	87 (19)	78 (17)	463
0623	SILVER LAKE	89 (20)	65 (15)	78 (18)	87 (20)	96 (22)	91 (20)	506
0624	TULLOCK RESERVOIR	52 (12)	54 (11)	35 (8)	17 (4)	87 (19)	57 (13)	302
0625	UPPER TWIN LAKES	70 (16)	98 (22)	87 (20)	65 (15)	87 (19)	78 (17)	485
0626	LOWER TWIN LAKES	74 (17)	87 (19)	96 (22)	78 (18)	37 (8)	91 (20)	463

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	0602	BOCA LAKE	539
2	0608	FALLEN LEAF RESERVOIR	527
3	0623	SILVER LAKE	506
4	0615	LAKE MARY	505
5	0625	UPPER TWIN LAKES	485
6	0626	LOWER TWIN LAKES	463
7	0622	SHAVER	463
8	0606	DON PEDRO RESERVOIR	370
9	0616	LAKE MENDOCINO	363
10	0621	SHASTA LAKE	328
11	0624	TULLOCK RESERVOIR	302
12	0604	CASITAS RESERVOIR	294
13	0619	LAKE PILLSBURY	279
14	0605	CROWLEY LAKE	268
15	0609	LAKE HENNESSEY	249
16	0620	SANTA MARGARITA LAKE	196
17	0617	NICASIO RESERVOIR	169
18	0603	LAKE BRITTON	164
19	0614	LOPEZ LAKE	134
20	0601	AMADOR RESERVOIR	134
21	0610	LAKE HENSHAW	130
22	0618	LOWER OTAY RESERVOIR	120
23	0607	LAKE ELSINORE	104
24	0611	IRON GATE RESERVOIR	104

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR CALIFORNIA 12/02/76

LAKE CODE 0618 LOWER OTAY RES.

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 256.4

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
0618E1	181.8	0.23	0.34	0.54	0.51	0.45	0.42	0.34	0.28	0.22	0.14	0.21	0.28	0.33
0618F1	0.8	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
0618ZZ	69.2	0.085	0.130	0.204	0.190	0.167	0.164	0.130	0.108	0.085	0.054	0.079	0.108	0.125

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 256.4
SUM OF SUB-DRAINAGE AREAS = 251.7
TOTAL FLOW IN = 5.49
TOTAL FLOW OUT = 0.0

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0618E1	11	74	0.0	16	0.0				
	12	74	0.0	20	0.0				
	1	75	0.0	19	0.0				
	2	75	0.0	22	0.0				
	3	75	0.011	8	0.0	16	0.008	23	0.005
	4	75	0.213	19	0.280				
	5	75	0.016						
	6	75	0.0	1	0.0	20	0.0		
	7	75	0.0						
	8	75	0.0						
	9	75	0.0						
	10	75	0.0						
0618F1	11	74	0.0	16	0.0				
	12	74	0.0	20	0.0				
	1	75	0.0	19	0.0				
	2	75	0.0	22	0.0				
	3	75	0.000	8	0.0	16	0.000	23	0.0
	4	75	0.001	19	0.001				
	5	75	0.000	31	0.0				
	6	75	0.0	20	0.0				
	7	75	0.0						
	8	75	0.0						
	9	75	0.0						
	10	75	0.0						
0618ZZ	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.004						
	4	75	0.082						
	5	75	0.006						
	6	75	0.0						
	7	75	0.0						
	8	75	0.0						
	9	75	0.0						
	10	75	0.0						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/09/24

061801
32 36 47.0 116 55 40.0 3
LOWER OTAY RESERVOIR
06073 CALIFORNIA

140891

11EPALES 2111202
0040 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/03/07	11 00	0000	14.0	8.0		944	8.50	159	0.200	1.700	0.020	0.013
	11 00	0005	13.6	7.8		934	8.50	163	0.210	1.200	0.020K	0.013
	11 00	0015	13.3	6.2		966	8.40	162	0.210	1.000	0.020K	0.011
	11 00	0025	12.2	3.0		955	7.95	170	0.260	0.900	0.020K	0.026
	11 00	0035	11.9	2.2		933	7.90	171	0.250	1.000	0.020K	0.018
75/06/20	11 45	0000	19.6	5.2	66	878	8.10	149	0.080	1.000	0.020	0.016
	11 45	0005	19.5	12.0		874	8.10	149	0.070	0.900	0.020K	0.012
	11 45	0015	19.4	8.0		874	8.10	148	0.070	0.800	0.020K	0.016
	11 45	0025	14.7	0.0		782	7.80	176	0.440	1.100	0.020	0.156
	11 45	0038	13.3	1.6		769	7.90	151	0.060	0.800	0.020K	0.018
75/11/14	13 30	0000	17.0	6.0	48	776	8.00	143	0.160	0.600	0.020	0.015
	13 30	0005	16.7	4.8		772	7.85	148	0.240	0.800	0.020K	0.009
	13 30	0015	16.6	4.8		775	7.85	142	0.260	0.900	0.020	0.008
	13 30	0034	16.5	4.8		767	7.83	142	0.140	0.900	0.020	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/03/07	11 00	0000	0.066	14.0	
	11 00	0005	0.058		
	11 00	0015	0.050		
	11 00	0025	0.053		
	11 00	0035	0.087		
75/06/20	11 45	0000	0.039	4.8	
	11 45	0005	0.037		
	11 45	0015	0.045		
	11 45	0025	0.198		
	11 45	0038	0.038		
75/11/14	13 30	0000	0.083	17.9	
	13 30	0005	0.064		
	13 30	0015	0.081		
	13 30	0034	0.076		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

061802
32 38 18.0 116 55 46.0 3
LOWER OTAY RESERVOIR
06073 CALIFORNIA
140891

11EPALES 2111202
0015 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/03/07	12 20	0000	13.8	7.6		927	8.45	164	0.220	1.100	0.020	0.011
	12 20	0005	13.8	7.4		911	8.40	164	0.220	1.100	0.020	0.018
	12 20	0011	13.3	6.8		917	8.30	162	0.210	0.800	0.020K	0.011
75/06/20	12 10	0000	19.8	7.8	61	882	8.10	150	0.060	0.900	0.020K	0.006
	12 10	0005	19.2	8.0		880	8.10	153	0.070	0.800	0.020K	0.009
	12 10	0015	19.1	6.8		876	8.10	155	0.060	0.800	0.020K	0.009
	12 10	0021	11.3	4.4		830	8.10	151	0.050	0.800	0.020K	0.009
75/11/14	13 50	0000	17.1	8.2	36	768	8.20	141	0.110	0.800	0.030	0.020
	13 50	0005	17.1	7.8		782	8.25	142	0.120	0.800	0.020	0.036
	13 50	0015	16.5	6.4		775	8.15	140	0.160	0.800	0.020	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/03/07	12 20	0000	0.059	15.7	
	12 20	0005	0.079		
	12 20	0011	0.053		
75/06/20	12 10	0000	0.036	4.7	
	12 10	0005	0.034		
	12 10	0015	0.033		
	12 10	0021	0.046		
75/11/14	13 50	0000	0.092	38.5	
	13 50	0005	0.086		
	13 50	0015	0.071		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/09/24

061881
32 36 28.0 116 55 40.0 4
2ND SAN DIEGO AQUEDUCT
06 7.5 OTAY MESA
0/LOWER OTAY RESERVOIR 140891
UPPER OTAY WTR TREATMENT PLANT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/16	10	55	0.096	0.800	0.045	0.015	0.050
74/12/20	09	30	0.104	0.500	0.011	0.005K	0.015
75/01/19	10	00	0.112	0.300	0.010		0.010K
75/03/08	09	00	0.104	1.050	0.024	0.008K	0.020
75/03/16	10	20	0.080	2.400	0.042	0.005	0.010
75/03/23	10	15	0.080	1.800	0.060	0.005K	0.010K
75/04/19	09	30	0.050	0.875	0.055	0.005K	0.020
75/05/20	09	30	0.025	1.350	0.030	0.005K	0.010
75/06/21	14	00	0.120	0.925	0.045	0.010	0.020
75/09/20	16	40	0.035	2.200	0.035	0.005K	0.020
75/10/18	10	30	0.060	2.200	0.030	0.005	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

0618CI
32 36 20.0 116 55 52.0 4
UNNAMED AQUEDUCT
06 7.5 OTAY MESA
T/LOWER OTAY RESERVOIR 140891
RAW WTR INTAKE FRM PLT .4 M SW SAVAGE DM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/16	10 40		0.064	2.500	0.220	0.070	0.130
74/12/20	10 15		0.044	1.650	0.024	0.015	0.090
75/01/19	10 15		0.048	0.700	0.030	0.020	0.050
75/02/22	09 05		0.064	2.600	0.803	0.072	0.151
75/03/08	09 05		0.008	1.400	0.016	0.016	0.060
75/03/16	10 30		0.062	3.900	0.173	0.033	0.080
75/03/23	10 00		0.060	2.500	0.175	0.030	0.070
75/04/19	09 35		0.010	1.550	0.035	0.025	0.040
75/06/21	14 30		0.090	2.600	0.085	0.010	0.050
75/08/23	10 00		0.030	1.050	0.070	0.035	0.100
75/09/20	16 30		0.040	1.200	0.035	0.020	0.060
75/10/18	09 30		0.025	2.800	0.065	0.025	0.070

STORET RETRIEVAL DATE 75/09/24

0618E1
32 38 15.0 116 53 00.0 4
JAMUL CREEK
06 7.5 JAMUL MTN
T/LOWER OTAY RESERVOIR 140891
OTAY LK RD BRDG 3.3 MI SE RNCH DEL OTAY
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/04/19	10 30		0.090	2.500	0.025	0.015	0.080

STORET RETRIEVAL DATE 76/09/24

0618G1
32 38 40.0 116 50 40.0 4
UNNAMED CREEK
06 7.5 JAMUL MTN
T/LOWER OTAY RESERVOIR 140891
100 FT ONSTRM FRM UNMPROVD RD XING
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/04/19	10 45		1.400	1.300	0.020	0.012	0.037